

DOCUMENT RESUME

ED 447 834

IR 057 956

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TITLE Information Literacy in Electronic Environments: Fantasies, Facts, and Futures.
PUB DATE 2000-07-00
NOTE 10p.; In: Virtual Libraries: Virtual Communities. Abstracts, Fulltext Documents and PowerPoint Presentations of Papers and Demos Given at the International Association of Technological University Libraries (IATUL) Conference (Brisbane, Queensland, Australia, July 3-7, 2000); see IR 057 942. On-line title varies slightly.
AVAILABLE FROM For full text:
http://educate.lib.chalmers.se/iatul/proceedcontents/qutpap/todd_full.html.
PUB TYPE Opinion Papers (120) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Libraries; Educational Principles; *Electronic Libraries; Higher Education; *Information Literacy; Information Retrieval; *Information Services; *Information Skills; *Instructional Design; Models; *Research Skills; Student Research; World Wide Web
IDENTIFIERS Electronic Resources

ABSTRACT

This paper focuses on the concept and practice of information literacy in relation to the virtual information environment. Key challenges for the development of digital information services are identified, and three fundamental components of information literacy (connecting with, interacting with, and utilizing information) and related research findings are summarized. Two tables present models of student research using traditional print-based information and World Wide Web-based information. Each table describes characteristics of the information environment and student responsibilities for six dimensions, i.e., starting point of search, document scope, document quality, information relevance, indicators of information quality, and information management. Implications for information literacy instruction related to the following learning principles are summarized: (1) learning is about making and maintaining connections; (2) learning is an active search for meaning; (3) learning is developmental--a cumulative process involving the whole person; (4) learning is both individual and social; (5) learning is strongly affected by the educational climate; (6) learning requires feedback, practice, and use; (7) much learning takes place informally and incidentally; (8) learning is grounded in particular contexts and individual experiences; (9) learning involves the ability of individuals to monitor their own learning; and (10) learning is enhanced by taking place in the contexts of compelling situations. (Contains 22 references.) (MES)

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INFORMATION LITERACY IN ELECTRONIC ENVIRONMENTS: FANTASIES, FACTS, AND FUTURES

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Introduction

In recent years, librarians, and particularly librarians in academic institutions, have invested considerable interest, energy and program development centring on information literacy. The complexity of this area is acknowledged: the multidimensional nature of the collective consciousness of information literacy; the variety of philosophical assumptions underpinning different conceptions of information literacy; the multidisciplinary contexts in which information literacy research is situated; the different professional approaches to the implementation and evaluation of information literacy initiatives; and indeed, the range of perceptions related to the why information literacy initiatives are indeed worthwhile. Central to the collective consciousness are concepts such as lifelong learning, independent learning, learning needs, information overload, and information rich, concepts that are central in the advocacy role that librarians, as chief protagonists, are playing in the information literacy agenda. The clarion call to information literacy has been heightened by developments in access to networked information technology, and the shift from a paper-based to a digital information environment. The development of the "digital library" or "virtual library" in particular has created an information environment that is complex and fluid, connective and interactive, and diverse and unpredictable, and where the professional provision of information is no longer constrained by time and place. It is becoming increasingly clear that information technology and the development and management of digital collections and information services is challenging and reshaping the way libraries do almost everything they do, and this has major implications for information literacy initiatives.

Virtual libraries and information literacy

Given that the theme of this conference is "Virtual Libraries: Virtual Communities", this paper focuses on the concept and practice of information literacy in relation to the virtual information environment. The concept of a "virtual library" is not merely equivalent to a digitised collection with information management tools. Rather, it is the creation of a holistic information environment that brings together "collections, services, and people in support of the full life cycle of creation, dissemination, use, and preservation of data, information, and knowledge". Lucier, Founding University Librarian and Executive Director of the University of California Digital Library asserts that "What is critical with the digital library is to look at what people's information needs are, and how we might use technology in order to solve those problems". Dempsey Director of the UK Office for Library and Information Networking provides four key challenges for the development of digital information services:

- *The challenge of the serving the active user:* Users want "resources bundled in terms of their own interests and needs, not determined by the constraints of media, the capabilities of the supplier, or by arbitrary historical practices";
- *The challenge of living with the radically new:* "...Fluidity replaces fixity as a dominant characteristic of resource creation and use. [Data] can be shared, reused, analysed; can be adapted, reconfigured, copied and newly combined in ways which were not possible before";
- *The challenge of planning for the radically unpredictable:* "Not only is change rapid, it is

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unpredictable."

- *The challenge of institution building:* "...we are only beginning to sense how institutions will be built and modified in digital spaces.

Dempsey challenges librarians to critically examine their roles and practices in order to address these challenges. A critical challenge centres on information literacy. Bruce argues that information literacy is "an appreciation of the complex ways of interacting with information. It is a way of thinking and reasoning about aspects of subject matter" Todd1 identifies three fundamental components of information literacy, each centring on a range of commonly accepted elements:

- *Connecting with the world of information:* understanding the real need; identifying and defining what needs to be known, creating approaches to meeting those needs; planning and developing search terms and search strategies, understanding the structure of the information base such as a catalogue, index, database, or web; implementing searching strategies to interrogate both sources and resources; operating the information technology appropriately; manipulating information objects such as books, files, fiche appropriately, compiling a hit list of located sources.
- *Interacting with the world of information:* knowing the indicators of quality information, questioning the relevance of the located resources, challenging, confirming or disconfirming the validity of the information, evaluating the appropriateness of the sources, filtering out unsuitable information, dealing with the threat of information overload, analysing the information to identify important and needed components, interpreting the information against frames of reference, understanding the ideas, organising the salient ideas into some meaningful structure to create a synthesis, critiquing multiple viewpoints and opposing ideas, reflecting on and evaluating the information process and the information product; working with information confidently, ethically, and methodically, being self motivated and venturesome, being goal oriented.
- *Utilising the world of information:* constructing new sense; getting direction; seeing the way ahead; taking action; applying the information to construct an answer to the question, solving the gap in previous understanding, finding help, getting direction and being able to move on, creating an information product, making decisions and implementing solutions, developing new applications.

Against this backdrop, a key implication for the provision of virtual networked information services is to ensure users' engagement with this rich information environment is active, purposeful, and satisfying. To date some significant research is emerging that is focusing on people's interactions with digital information, and key implications for the development of information literacy are emerging. On the one hand, there is a conception that people, especially young people in particular are gurus in this vast digital world yet on the other, emerging research evidence is clearly suggesting that the intuitiveness, ease, certainty, and success as input and outcome attributes of searching the World Wide Web are highly questionable. This research, primarily American, provides insights into the cognitions, behaviours and emotions that are commonly experienced during the process of interacting with electronic information, particularly the World Wide Web. Kehoe claims "Turning information into knowledge is the most intellectually challenging, time-consuming, and potentially controversial process. An information flood does not necessarily mean that people become informed". The following research evidence, based on samples of primary school students through to students in tertiary education, highlights significant dilemmas in connecting with, interacting with, and utilising Web-based information.

INFORMATION LITERACY DIMENSION	RESEARCH FINDINGS
Connecting with information	Aitkin ; Watson ;: high levels of information overload; inability to manage and reduce large volumes of information; Bilal & Watson ; McNicholas & Todd ; Todd : failure to retrieve documents based on aboutness; formulating ineffective search queries; failure to utilise Boolean operators Kuhlthau ; McNicholas & Todd 11; Watson 9: considerable - insecurity and uncertainty when searching; McNicholas & Todd 11; Kafai & Bates 14: problems with working with search engines Hertzberg & Rudner 15; Nims & Rich 16: tendency to conduct simple searches, crafting poor searches; considerable guessing of appropriate terms; Nims & Rich 16: high expectation of the technology's ability to make up for poor searing techniques Fidel 17: examine only first screens of most sites Schacter, Hung & Dorr 18: preferred browsing techniques to systematic, analytic-based strategies; Hirsh 19: motivation for searching decreases when site load time is slow, and especially in relation to graphics – technical implications
Interacting with information	Aitkin8: coping strategies – filtering, simplification, errors, delegating; feelings of confusion and frustration; Bilal & Watson 10; Hirsh,19: not thinking critically and evaluatively in searching; limited use of thesaurus Hertzberg & Rudner 15: typical user only performs 2 or 3 inquiries per search; very small number of citations examined (5-6); abort searches quickly; McNicholas & Todd 11; Schacter, Hung & Dorr 18; Hirsh 19: inability to judge quality of information Watson 9: inability to question the accuracy of web information McNicholas & Todd 11; Wallace & Kuperman 20; Hirsh 19: not able to judge relevance of information; Fidel 17: often inappropriately favouring visual cues; minimalist behaviour – made quick decisions at all stages of search process; looked at pictures rather than textual information as signs of relevance; use of “landmarks” rather than indepth critical analysis of sites to judge relevance and quality
Utilising information	McNicholas & Todd 11: project management issues of time, workload management, meeting deadlines Hertzberg & Rudner 15: median amount of time spent in searching was 5-6 minutes; willing to construct answer on limited information; Users satisfied to utilise any somewhat-relevant hit McNicholas & Todd 11: tendency to plagairise

The development of the “digital library” or “virtual library”, particularly with its emphasis on web-based connectivity and interactivity, has created an information environment that is complex and fluid, connective and interactive, and diverse and unpredictable. This selective review of some current research suggests that there are real dilemmas related to connecting to, interacting with, and utilising this information world. The identification of these very dilemmas provide substantial direction for

information literacy initiatives on which libraries might focus. Focusing on enabling library users to actively engage with ease in this complex, dynamically changing information environment should be a fundamental direction of information literacy initiatives. These directions, however, should not be built on a deficit or deficiency model of information literacy 1, where users are seen as deficient because they do not have such competencies; rather, they should be underpinned by a sense of empowering people to develop their full potential in solving their problems through effectively engaging with their information environments.

However, there are more complex issues involved in engaging in electronic information environments, which have implications for information literacy initiatives. I would suggest that one of these issues is the current practice of subject-based searching²¹. Historically, aboutness or topicality or keyword has been the most common starting point for information searching. Indeed, the notion of defining the information need, usually expressed as a content-rich topic, has been a fundamental process of traditional information literacy. This has generally worked successfully, primarily because the volume of resources retrieved in the past has been actually quite small, and because the quality of the resources has been prejudged by librarians and educators, thus not generally requiring users to engage in judgements of quality. Rather, in the past, the key judgement users have had to make has been that of judging the relevance of specific messages appropriate to the information need, and selecting those through an analysis process, and discarding the rest. The following table presents this model of searching in traditional print-based information ²² in the context of a student undertaking a research task:

<i>Dimension</i>	<i>Traditional (pre-www) information environments – eg libraries</i>	<i>Student responsibility</i>
Starting point of search	Subject / key word / aboutness / topicality	Key words primarily provided (in task documentation) rather than self-derived
Document scope	Limited number of information sources on topic; limited to single or multiple library collections	Use key word to search library databases or browse physical collection to retrieve limited set of documents
Document quality	Predetermined by librarians and educators; carefully chosen against documented selection criteria	Limited involvement: have not developed skills of judging the quality of document – recognise that this is done by librarians or educators, and is not required at a specific detailed level by students
Information relevance	Assumes students have clearly developed skills in identifying information messages relevant to topic; use only a limited retrieved set of documents to provide the information messages appropriate to task	Assumes students have an understanding of the criteria for judging the appropriateness / relevance of the information messages
Indicators of information quality	Generally clearly embedded in the resources: blurbs on authors, publisher's CIP data, introduction and preface	Assumes students are able to use these criteria in making decisions about quality and relevance of information
Information management	Low levels of overload, with uncertainty and lack of confidence minimised	Relies on effective note-taking and time management skills to reduce overload;

Research evidence, as presented in the summary presented earlier, indicates that aboutness or topicality

becomes problematic in Web-based searches, a problem that is illustrated simply by the very large number of documents retrieved on most topics through any one of the hundreds of search engines. Unlike the limited, carefully chosen, structured collections of libraries, the World Wide Web provides widespread accessibility to vast quantities of information; information whose content is uncontrolled, unfiltered, unorganised, and unclassified. The starting point of the search process becomes problematic, not just in terms of the sheer quantity and quality of web pages that are likely to be produced, but also in terms of the diversity of linguistic expression of the Web. It is also made even more complex because the search engines available all have different approaches to deciding what a document is about, that is, its aboutness. Approaches include: plain text searching, broad concepts and concept trees, cast-of-characters approach where key ideas, names and places are determined by frequency counts, and various thematic approaches. The outcome of a search is often high recall of supposedly relevant documents, and low precision of documents when the recalled list is examined and assessed against the information need. Once a document set has been retrieved, students have the task of searching through this huge base to identify relevant items. The complexities of judging both quality of web pages and relevance of information messages are overwhelming, creating an overload situation and associated feelings of anxiety and uncertainty. The problems are illustrated in the table below²¹:

<i>Dimension</i>	<i>Web-based information</i>	<i>Student responsibility</i>
Starting point of search	Subject / key word / aboutness / topicality problematic because of high retrieval rate	Need to consider implications of natural language searching and linguistic expression
Document scope	Large number of information sources on topic; not limited to single library collection	Need to construct search string to generate precise list; understanding of Boolean Operators; understanding of the scope of search engines
Document quality	Extremely variable – from high quality to poor quality on a range of quality criteria	Need to understand what constitutes “quality” information in a particular discipline; need guidance in identifying appropriate sources / places
Information relevance	Assumes students have clearly developed skills in identifying information messages relevant to topic; large sets of retrieved documents increases cognitive load required of this task	Assumes students have an understanding of the criteria for judging the appropriateness of the information messages
Indicators of information quality	Not clearly evident, and variably represented; some available through metadata specifications	Assumes students are able to identify on screen indicators of quality in making decisions about quality and relevance of information
Information management	High levels of overload, with uncertainty and lack of confidence increased	Creates problems in relation to time management skills to reduce overload; problems in relation to search management; creates environment for plagiarism

For example, consider the following History research task “*The concepts of land, kinship and culture sum up Koorie identity. Present an analysis and synthesis of evidence that argues this claim.*” Searching Alta Vista on key words explicit or implicit in this task would generate large numbers of web pages. This is typically what happens. “Defining” skills of students would generate search terms such as “Koorie”, “kinship”, “Australian Aborigines”, “land”, “culture” without much effort. The following results were retrieved (1st July 2000): Land: 8,328,872 web pages; Culture: 6,806,282, web pages; Koorie: 2,056 web pages; kinship: 54,250 web pages; Australian Aborigines: 7,762 web pages; land

rights: 25,063 pages.

Approaching the search by having students consider the place where quality information specific to the topic might be available, rather than subject, is likely to yield successful relevant searches quickly and easily. Rather than subjects, the following place search terms might be used to begin the search: Aboriginal & Torres Strait Islander Commission; Australian Institute of Aboriginal and Torres Strait Islander Studies (Canberra); Aboriginal Lands Group; Aboriginal Studies Press; and the Human Rights and Equal Opportunity Commission. Such an approach demands that students (and teachers) actually understand what constitutes "quality" information, and what might be quality places for the information. The dimension of "placeness", in addition to "aboutness" should become an important concept in defining stage of the search process. This is just one example that suggests we need to think more creatively and laterally as to how we might approach the resolution of the searching dilemmas users face through information literacy initiatives.

There are other significant implications for information literacy. Given the context of this conference is technological universities, and the specific focus is "virtual communities"; the development of these information and indeed critical literacies needs to be embedded more strongly in an understanding of the learning environment in which their development takes place. Having been involved in information literacy teaching and research for many years, I want to pose – gently – what I think is one of the key issues facing the effective information literacy development in the university environment. This issue centres on the effective development of instructional strategies focusing on information literacy. A significant work I came across recently elaborated 10 key principles of shared learning, based on a synthesis of ongoing research about the nature of effective learning. These principles of shared learning provide directions for how information literacy initiatives might be successfully implemented.

Learning Principle	Implications for Information Literacy Instruction
1. Learning is about making and maintaining connections: linking concepts, ideas, meaning; linking mind and environment; linking self and others; linking deliberation and action.	Information literacy is all about enabling people making connections. Instruction should link needs to experience; Give learners responsibility for solving problems and resolving conflicts; Make explicit the relationships of need to the curriculum; Personalise interventions appropriate to learners' circumstances and needs
2. Learning is an active search for meaning by the learner: it is about constructing knowledge rather than passively receiving it; involving learners directly in discovery of knowledge; enabling them to transform prior knowledge and experience, and to take responsibility for learning	Maximise opportunities for student participation; Extension activities for growth and development; Provide meaningful experiences linked to curriculum, or life; Opportunities to critique process; reflect on outcome; identify needs; Opportunities for brainstorming and predicting solutions
3. Learning is developmental, a cumulative process involving whole person: Intellectual growth is gradual: advancement, consolidation, reinforcement; Integrated sense of identity	Progressive, developmental nature of each learning experience; Instruction should be additive and cumulative -> greater richness, complexity; Tracking student development of competence; Opportunities for trialing, testing, reviewing; Opportunities for needs assessment, discussion, reflection
4. Learning is both individual and social:	Peer tutoring and learning from each other;

Responsive to students' personal histories and common cultures;
 Opportunities for co-operative learning;
 Cultivating and inclusive community;
 Valuing human differences

5. Learning is strongly affected by educational climate in which it takes place:

value academic and personal success and intellectual inquiry;
 involve all constituents in contributing to effective student learning feeling connected, cared for and trusted

6. Learning requires feedback, practice, and use

Feedback -> sustained learning
 Practice -> nourishing learning
 Opportunities to use -> meaningful learning

7. Much learning takes place informally and incidentally

Activities beyond classroom enrich formal learning experiences;
 Mentoring relationships beyond the classroom;
 Learning in a variety of setting and circumstances

8. Learning is grounded in particular contexts and individual experiences

Requires effort to transfer specific knowledge and skills to new circumstances;
 Grounded nature of learning:
 encounter alternative perspectives and other realities

9. Learning involves ability of individuals to monitor own learning

Understand how knowledge is acquired;
 Know how to work with capacities and limitations;
 Awareness of own ways of knowing
 Ability to monitor own learning

10. Learning is enhanced by taking place in the context of compelling situations

Provides challenge and opportunity
 Stimulates brain to conceptualise, contemplate and reflect
 Amplifies the learning process

Enable students from different cultural backgrounds to experience each other's traditions
 - choice of resources; Creative approaches responsive to different learning styles;
 Development of self-learning packages

Library can play a key role in building a strong sense of community: Empowerment model rather than deficiency model;
 Learning environment in which students feel connected, cared for, trusted;
 Team teaching with academic partners;
 Evaluate process and benefits to students;
 Celebrate success

Encourage goal setting;
 Provide information on progress towards meeting learning goals;
 Recurring process of needs analysis and improvement;
 Risk taking and learning from mistakes;
 Development of learners as constructive critics;
 Active problem solving and refining skills

Creative and imaginative approaches to instruction - not necessarily the group one-size-fits-all approach
 Rethink distribution of responsibilities:
 Information Literacy support staff;
 Library staff in mentoring relationships;
 Use of volunteers and activists;
 On-line help points: quick-fix

Tailor education to individual rather than mass-produced delivery;
 Use of educational technologies as tool for collaborative learning;
 Understand factors which affect student cognition;
 Meet students on their turf;
 Curriculum co-ordination to contextualise learning experience;
 Challenge conventional views

Help students understand their strengths and weaknesses in learning;
 Help students observe and record their own progress in learning;
 Use of multiple pedagogies

Students learn more when:
 asked to tackle complex and compelling problems that invite them to develop an array of workable and innovative solutions;
 produce work to be shared with multiple audiences
 offered opportunities for active application of skills and abilities;

placed in settings where they can draw on past knowledge and competencies

Conclusion

The current research on users' engagements with digital information environments, set against an understanding of recent research on learning, provides some significant opportunities for those engaged in information literacy instruction to reflect and critique current practices, understand emerging learning dilemmas, and to rethink how instructional design for information literacy might appropriately be undertaken. There is some clear evidence that information searchers are facing some real challenges and barriers to effective information seeking in digital environments. It is an important time for those engaged in information literacy instruction to respond collaboratively, creatively and transformatively, based on an understanding of information needs and learning design, to ensure information seekers are able to engage meaningfully and purposefully in their information world. At the core of this is critically evaluating the educative role of the librarian somewhat beyond the mastery of databases, sources and collections, and, through a shared learning framework, examining how real value can be added to the real needs of information seekers.

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Last edited by J.F., 23rd September, 2000.